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(54) METHOD AND APPARATUS FOR MANUFACTURING A PAPER STRIP

(71) We, AIR INDUSTRIE, formerly (TUNZINI AMELIORAIR, THERMIQUE AERAULIQUE, MECANIQUE (T.A.M.)., a French Body Corporate, of 90 rue Cardinet, 75 Paris (17), France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a method and apparatus for manufacturing a paper strip coated on one face with an adhesive which is non-sticky in the dry state, for example pre-gummed wallpaper. The coating of the paper strip with adhesive e.g. dry paste or gum, is usually carried out by subjecting one surface of the paper in the dry state to the application of a liquid adhesive followed by a powdering with grains of adhesive which are non-sticky in the dry state but which are able to become sticky in the presence of water — for example grains of starch, and then to light brushing to remove any particles adhering imperfectly thereto. The paper thus coated can be used subsequently for attachment to a wall by moistening it so as to render sticky the grains of gum fixed in the dry state.

This method has a certain number of drawbacks connected with the method of spraying the dry grains of adhesive which is usually effected by simple pneumatic nozzles or by vibrating sieves. The grains have the tendency to form agglomerates. The density of distribution on the sheet of paper is extremely varied and a large proportion of the grains is sprayed beyond the area of the sheet, escaping laterally under the action of the air current which transports them from the supply station of the particles and/or under the action of an air current due to displacement of the sheet of paper when this latter is travelling at high speed. On the other hand, the adherence of the grains depends to a large extent on the strength of their incrustation in the support formed by the liquid adhesive so that one has been led to use grains of adhesive of quite appreciable sizes which detract from the quality and continuity of the coating without however enabling fixation of the finer grains necessarily associated with the coarser particles.

From one aspect the invention consists in a method of manufacturing a paper strip coated on one face with an adhesive which is non-sticky in the dry state, wherein one face of a paper strip in the dry state is subjected to the application of a liquid adhesive and of grains of adhesive in the dry state, and wherein an electrostatic field is created in a region including a length of the strip to electrically charge, and apply, said grains to said one face of the strip and then the coated strip is dried so that grains of adhesive are adhered thereto. Electrostatic powdering application of the dry grains of adhesive for example, starch grains can be carried out by any known method, by applying a very high electric potential of several tens of thousands of volts to an ionising charge electrode by providing an earthed counter-electrode opposite the ionizing electrode and by causing the dry grains to pass through the ionization zone of the electrode where they are electrically charged.

From another aspect the invention consists in apparatus when used for carrying out the above method, comprising a feed for a roll of paper strip in the dry state, means for applying liquid adhesive to one face of the paper strip at a first station, means for creating an electrostatic field, at a distribution station for dry grains of adhesive, in a region including a length of the strip, to electrically charge and apply said grains to one face of the strip, said means for creating an electrostatic field including an electrode at high voltage for electrically charging said dry

grains and an earthed counter electrode, and said apparatus further comprising an oven for drying the coated strip to adhere dry grains of adhesive thereto and a winder for the dried coated strip.

The counter-electrode may be formed by the paper strip itself since the liquid adsive moistens the paper strip usually rendering the cellulose material of the paper sufficiently conductive. It is then sufficient to provide one or more earthed rollers on which the paper strip bears.

Electrostatic application of dry grain of adhesive has numerous advantages. On the one hand, it homogenises the cloud of grains travelling towards the sheet by the effect of electric repulsion of the charged particles of same polarity. It thus avoids the formation of agglomerates and ensures uniformity of the deposit made on the sheet. Since the grains of dry adhesive are substantially submitted to the drive force due to the electric field, considerable improvement results therefrom in the percentage of particles which reach the sheet and a correlative reduction in the losses. The effect of electrostatic deposition being largely predominant over the effects of the secondary air currents, the speed of travel of the paper strip can be increased and thus the hourly output of the apparatus is improved. However, above all, the effect of the electrostatic field is applied to all the grains whatever their size; the fine particles being driven at a force proportionally equal to that which is exerted on the larger particles. This has the result that grains of much finer granular size can be used which enables better fineness of the network of grains on the sheet, a notable decrease in the density of grains required on the sheet to obtain the same ultimate adhering effect and increased adherence of the liquid adhesive on each grain. The effect of electrostatic deposition is to ensure a genuine impact of the grains on the layer of sticky or liquid adhesive and partial penetration of these latter into the gum, thus better incrustation. In this manner the adherence of the grains with respect to the ulterior brushing is better and their adherence in time is considerably improved.

In a preferred embodiment of the method the application of dry grains of adhesive immediately follows liquid adhesive application. It is, in fact, necessary to operate rapidly to avoid complete moistening of the sheet of paper. This is the reason why the drying treatment in an oven is also effected immediately after the electrostatic application. Alternatively, electrostatic application of dry grains may take place simultaneously or practically simultaneously to the liquid adhesive application or may even precede this latter. This enables the duration of retention of the adhesive in the liquid state to be reduced, by reducing the distance between the liquid adhesive application station and the drying station. Liquid adhesive application may itself be effected electrostatically with the aid of a spraying nozzle, advantageously of the pneumatic type, and in this case the electric charges of the liquid particles of adhesive and dry grains may be either of the same polarity or of opposite polarity, which ensures moreover, a certain electrical attachment of the grains in the liquid gum and a greater force of application of the dry grains when the operation of spraying the grains follows the application of liquid adhesive.

The invention will now be further described, by way of example, with reference to the accompanying drawing which shows in a diagrammatic manner one embodiment of apparatus for carrying out the method of the invention.

The installation comprises a wind-off or feed roller 1 for a roll of paper 20 in the dry state and a plurality of guide rollers 2, 3, 4 for the length of paper between the roller 1 and a wind-up roller 6. A liquid adhesive application station 7 is arranged between the rollers 2 and 3 and is formed by a tank 8 and a coating or lick roller 9 on which the dry paper strip bears. An electrostatic spray station 10 for the grains of adhesive in the dry state is disposed between the rollers 3 and 4 and is formed by a plurality of aligned nozzles 11 of a type known *per se* which effect pneumatic spraying and which are carried to a high electrical potential by a nozzle electrode connected to an electric source 12. An electrostatic field is created between a counter-electrode and the electrodes in the nozzles 11 in a region including a length of the paper strip. The counter electrode can be the length of the paper strip facing the station 10, for the strip is usually sufficiently moistened by the previous coating of liquid adhesive to be conductive. In this case it is sufficient to earth at 13 the guide roller or rollers 4 adjacent the powdering station 10. However, an earthed plate 14 can be provided behind the strip as shown in the drawing. The pneumatic spraying nozzles 11 are advantageously of the type which create a whirling air movement which ensures helicoidal movement over a large angle for the grains. This type of nozzle has the advantage of forcing the grains to cross the area of high ionisation for a maximum duration, usually formed by the discharge outlet of the nozzle, and to reduce the axial speed of the grains so that the strength of the electric field is thereby increased. A drying oven 15 is disposed between the rollers 4 and 5.

Instead of using an atomisation nozzle 11, as is known, the dry grains of adhesive can

be disposed in a bed which is fluidized by means of a gas and which contains ionizing electrodes, the paper strip being moved above the bed and the ionizing electrodes charging the grains which are attracted to, and coat one face of the strip, or a powdering cloud could be formed previously, which would then be charged.

Instead if using the lick roller 9, a pneumatic spray nozzle could be used, preferably an electrostatic nozzle creating a whirling air movement.

As a liquid adhesive, it is suitable to use an adhesive having a double affinity, on the one hand to cellulose fibres forming the sheet of paper, on the other hand to the grains of dry adhesive such as starch. A solution of carboxyl-methyl-cellulose (C.M.C.) in water has been used at a concentration of 0.5% to 1.5% disposed in a "Size press" at the rate of 0.5 to 1 g/m^2 of dry extract.

The grains of dry adhesive are for example pre-baked starch grains, i.e. having been subjected to previous treatment which enables its gelatinisation in cold water (10 to 20°C) without heating.

By way of example: the powder is deposited at the rate of 5 to 15 g/m^2 on a sheet moving at 50 m/mn. A powdering nozzle covers a strip 30 cm wide approximately and in this case its powder flow varies from 5 to 15 KG per hour. The voltage used is 90 KV for a distance between nozzles and sheets of paper of 20 to 30 cm approximately. The nozzles are arranged side-by-side on a line perpendicular to the trajectory of the sheet at a distance of approximately 30 cm. In order to improve the overlapping of the spray of one nozzle by the spray of the other, they can also be arranged in staggered fashion on two lines slightly offset, the nozzles of uneven order being on the front line and the nozzles of even order on the second (spacing between nozzles on one line 60 cm, spacing between two lines 10 to 30 cm).

WHAT WE CLAIM IS:—

1. A method of manufacturing a paper strip coated on one face with an adhesive which is non-sticky in the dry state, wherein one face of a paper strip in the dry state is subjected to the application of a liquid adhesive and of grains of adhesive in the dry state, and wherein an electrostatic field is created in a region including a length of the strip to electrically charge, and apply, said grains to said one face of the strip and then the coated strip is dried so that grains of adhesive are adhered thereto.

2. A method according to claim 1, wherein the application of dry grains of adhesive immediately follows the application of liquid adhesive.

3. A method according to claim 1, wherein the application of dry grains of adhesive takes place simultaneously with the application of liquid adhesive.

4. A method according to claim 1, wherein the application of dry grains of adhesive precedes the application of liquid adhesive.

5. A method according to any preceding claim, wherein the application of liquid adhesive is effected electrostatically by means of an atomisation nozzle.

6. A method according to claim 5, wherein the electrostatic liquid adhesive application and the electrostatic application of dry grains of adhesive are carried out at the same polarity of the electric charge of the liquid particles of adhesive and dry grains of adhesive.

7. A method according to claim 5, wherein the electrostatic liquid adhesive application and electrostatic application of dry grains of adhesive are carried out at opposite polarities of the electric charge of the liquid particles and dry grains respectively.

8. A method according to any preceding claim, wherein the grains of adhesive are starch grains.

9. A method according to any preceding claim, wherein said paper strip is a strip of wallpaper.

10. A method of manufacturing a paper strip which is coated on one face with an adhesive which is non-sticky in the dry state according to claim 1 and substantially as hereinbefore described.

11. A coated paper strip produced by the method of any of the preceding claims.

12. Apparatus when used for carrying out the method according to claim 1, comprising a feed for a roll of paper strip in the dry state, means for applying liquid adhesive to one face of the paper strip at a first station, means for creating an electrostatic field, at a distribution station for dry grains of adhesive, in a region including a length of the strip, to electrically charge and apply said grains to one face of the strip, said means creating an electrostatic field including an electrode at high voltage for electrically charging said dry grains and an earthed counter electrode, and said apparatus further comprising an oven for drying the coated strip to adhere dry grains of adhesive thereto and a winder for the dried coated strip.

13. Apparatus as claimed in claim 12, wherein the earthed counter-electrode includes said length of the paper strip.

14. Apparatus according to claim 12 and when used for carrying out the method according to claim 2, wherein said distribution station for the dry grains is located downstream according to the direction of

travel of the strip from the liquid adhesive application station.

15. Apparatus according to claim 12, and when used for carrying out the method according to claim 3, wherein the distribution station for the dry grains is located immediately adjacent the liquid adhesive application station.

16. Apparatus according to claim 11 and when used for carrying out the method according to claim 4, wherein the distribution station for the dry grains is located upstream according to the direction of travel of the strip, from the liquid adhesive application station.

17. Apparatus according to claim 15 and when used for carrying out the method according to claim 5, including nozzles for spraying liquid adhesive by atomisation and dry grains of adhesive, said nozzles being arranged to provide overlapping sprays.

18. Apparatus according to claim 15 and when used for carrying out the method according to claim 5, including respective electrostatic nozzles for simultaneously spraying atomized liquid adhesive and dry grains of adhesive.

19. Apparatus according to claim 12, including nozzles for spraying dry grains of adhesive and/or atomisation of the liquid adhesive and of the type which create a whirling air movement.

20. Apparatus when used for carrying out the method according to claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*